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OCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

Herbicides Ineffective in Controlling Southwestern Dwarf Mistletoe

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The oil-soluble omine ond butoxyethonol ester of 2,4,5-trichlorophenoxy butyric ocid (4-(2,4,5-TB)) in concentrations of 0.5, 1.5, ond 3.0 percent were used in o triol to control southwestern dworf mistletoe. Both were ineffective in reducing the infection levels of the porasite in ponderosa pine trees in northern New Mexico.

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The National Park Service and the USDA Forest Service in Arizona and New Mexico are concerned about high infection rates of dwarf mistletoe (Arceuthobium vaginatum subsp. cryptopodum (Engelm.) Hawks. and Weins) in ponderosa pine (Pinus ponderosa Laws.) in heavy use areas, such as those around Park Headquarters, picnic areas, and in scenic roadside strips (Lightle and Hawksworth 1973). For many years the only available methods for controlling dwarf mistletoe have been silvicultural. While these methods are applicable to forest stands in general, there is a growing need for a control method to save individual high-value trees. A chemical that would eliminate the parasite from the tree, without undue damage to the host, would be desirable.

Quick (1964) evaluated experimental herbicides to control dwarf mistletoe in some conifer species in California. His most promising chemical was the isooctyl ester (IOE) of 2,4,5-trichlorophenoxy butyric acid (4-(2,4,5-TB)), followed by the butoxyethanol ester (BOEE) and the oil-soluble amine (OSA) formulations. He reported these materials to be effective over a rather broad range of concentrations (0.2 to 1.5 percent acid equivalent) when applied directly to the dwarf mistletoe infections and the surrounding bark. A cooperative test of some of these promising materials was installed at Bandelier National Monument, New Mexico, in 1965. The purpose of this Note is to report the results of that test.

Methods and Materials

The BOEE and the OSA formulations of 2,4,5-TB were used in three concentrations (0.5, 1.5, and 3.0 percent acid equivalent) in a number 2 stove oil carrier. (The IOE formulation was not available from the manufacturer when this test was made.) These, together with the carrier alone and no treatment, gave a total of eight treatments.

Six hundred and three ponderosa pine trees were tagged, and their diameters at breast height (d.b.h.), and total heights measured. The smallest tree treated in each case was less than 6 feet high. Each tree was rated for dwarf mistletoe according to the 6-point system

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(Hawksworth 1961, p. 77). In addition, the numbers of branch and bole infections were recorded.

The trees used in each treatment were essentially equivalent (table 1). Average d.b.h. varied from 2.6 to 3.1 inches. With the exception of the trees that received no treatment, the proportion of infected trees was nearly equal, and ranged from 89.7 to 93.5 percent. The average dwarf mistletoe rating for the trees in each treatment also was similar and varied from 2.7 to 3.2.

Treatments were randomly assigned so that approximately the same number of trees was included in each treatment, except for the "no treatment" category. Chemicals were applied as a spray from small, pressure-type garden sprayers. They were sprayed directly on the dwarf mistletoe shoots, and on the bark of the host approximately 12 inches beyond signs of infection, until the solution dripped or ran off. The bark was thoroughly wetted, and the branch or bole was treated completely around the circumference. Trees to be treated that had infections higher than could be reached from the ground were sprayed from ladders. All treatments were applied during the first week in October 1965.

Trees were examined 1, 2, and 6½ years after treatment. The following rating system, similar to Quick's 5-step scale, was used to rate both damage to the host and effectiveness against the parasite:

Tree or infection —	Treatment-effectiveness scale	
	Quick	Lightle
Dead	5	5
Looks dead	4	4
Seriously affected	3	3
Affected, but not seriously so	2	2
Very slightly affected	-	1
Not affected	1	0

Results and Discussion

Damage to uninfected trees from the sprayed chemicals was very slight (all were rated one). Damage to infected trees varied considerably from tree to tree but in general was negligible (1.3 to 1.7). Apparent effectiveness of the materials decreased with time after treatment so that after 6 years very little effect from the treatment could be recognized (table 2). The average dwarf mistletoe rating for the trees in each treatment varied only slightly after 6 years (table 2). No major difference among the various treatments was apparent.

An analysis of trees that died during the test period showed some correlation with dwarf mistletoe severity, as might be expected, but little with treatment (table 3). Fifteen percent of the trees that died had no dwarf mistletoe and received no treatment. The cause of their

Table 1.--Comparison of pretreatment data (1965) for areas to be treated to control dwarf mistletoe at Bandelier National Monument

Planned treatment	Total trees (603)	Diameter at breast height		Trees infected	Dwarf mistletoe rating (6-class)[1]
		Average	Largest tree		
	Number	*Inches*		*Percent*	
None (check)	173	3.1	15.4	11.6	2.7
Oil-soluble amine					
0.5 percent	66	3.0	9.1	90.9	3.1
1.5 percent	61	2.6	8.6	90.2	2.7
3.0 percent	57	2.9	7.3	93.0	3.0
Butoxyethanol ester					
0.5 percent	59	2.9	11.9	91.5	3.1
1.5 percent	62	2.8	9.2	93.5	3.0
3.0 percent	58	2.9	8.7	89.7	3.0
Carrier (stove oil)	57	2.8	8.3	91.2	3.2

[1]Based on 6-class rating system developed by Hawksworth (1961, p. 77); includes uninfected trees.

Table 2.--Effectiveness of chemicals against dwarf mistletoe and average infection rating of trees in the control test at Bandelier National Monument

Treatment	Original dwarf mistletoe rating (6-class)[1]	Treatment effectiveness (5-class)[2]			Average dwarf mistletoe rating (6-class)[1]	
		1st year	2nd year	6th year	End of study	6-year change
None (check)	2.7				2.2	-0.5
Oil-soluble amine						
0.5 percent	3.1	4.1	2.3	2.0	3.1	0
1.5 percent	2.7	4.2	2.1	1.8	2.6	-0.1
3.0 percent	3.0	4.0	1.7	2.0	3.5	+0.5
Butoxyethanol ester						
0.5 percent	3.1	4.3	2.0	2.0	3.4	+0.3
1.5 percent	3.0	4.1	1.9	1.9	3.4	+0.4
3.0 percent	3.0	4.3	2.1	2.1	2.7	-0.3
Carrier (stove oil)	3.2	4.2	2.1	1.9	3.2	0

[1]Based on 6-class rating system developed by Hawksworth (1961, p. 77); includes uninfected trees.
[2]Based on 5-class treatment-effectiveness scale on page 2.

deaths was not determined. However, since two-thirds of them were less than 1 inch d.b.h., including three that were less than 6 feet tall, suppression was the probable cause of death.

Literature Cited

Hawksworth, F. G.
1961. Dwarfmistletoe of ponderosa pine in the Southwest. U.S. Dep. Agric. Tech. Bull. 1246, 112 p.

Lightle, Paul C., and Frank G. Hawksworth.
1973. Control of dwarf mistletoe in a heavily used ponderosa pine recreation forest: Grand Canyon, Arizona. USDA For. Serv. Res. Pap. RM-106, 22 p. Rocky Mt. For. and Range Exp. Stn., Fort Collins, Colo.

Quick, Clarence R.
1964. Experimental herbicidal control of dwarfmistletoe on some California conifers. U.S. For. Serv. Res. Note PSW-47, 9 p. Pac. Southwest For. and Range Exp. Stn., Berkeley, Calif.

Table 3.--Numbers of trees that died (100) during 6 years in Bandelier National Monument chemical control test

Treatment	Tree mortality in relation to original dwarf mistletoe rating							Total
	0	1	2	3	4	5	6	
	Number							
None (check)	15	0	0	1	1	0	0	17
Oil-soluble amine								
0.5 percent	0	0	1	3	2	1	9	16
1.5 percent	0	0	0	2	0	1	5	8
3.0 percent	0	1	0	2	0	0	4	7
Butoxyethanol ester								
0.5 percent	1	0	1	1	0	0	8	11
1.5 percent	0	2	1	2	0	0	6	11
3.0 percent	1	3	0	1	1	0	9	14
Carrier (stove oil)	0	1	1	3	1	1	9	16
Total	17	7	4	15	5	3	49	100